Concordia, Kans., 18th: a bright meteor was observed passing from east to west at 10.15 p. m., leaving a streamer of pale white light 60° long in its wake.

Wilmington, N. C.: a brilliant meteor flashed across the sky from north to south at 11 p. m., 20th. The meteor left a silvery trail of light, like that of a sky-rocket, and when near the earth it burst into fragments and disappeared from view.

Nashville, Tenn.: a brilliant meteor was observed at 9.15 p. m., 23d, about 2° southeast of the zenith, and disappeared when about 10° above the southeastern horizon.

Whipple Barracks, Ariz.: a brilliant meteor was observed at 11 p. m., 27th, in azimuth 100° and altitude 75°; it travelled about 25° in a westerly direction and disappeared.

Little Rock, Ark.: a number of meteors were observed during the evening of the 27th, one of which was very bright, and was seen at 9.18 p. m., moving slowly from south to north, and having a bright orange-colored trail.

Charleston, Coles Co., Ill., 31st: a meteor was observed in the north, in altitude about 20°, at 8.40 p. m.; it shot across the sky in a southward direction, leaving a long white trail of light in its path. The meteor disappeared when about the same altitude in the south.—*Report of Mr. J. B. Dazey.*

MIRAGE.

Mirage were observed at Leech Farm, Dak., 30th, and at Traverse City, Mich., 31st.

SAND STORMS.

San Carlos, Ariz.: a severe sand storm occurred between 7.25 a. m. and 11.30 a. m., 3d. The sand and dust were so thick as to obstruct the view, objects six feet distant were not discernible, and the furniture in closed houses was covered by a layer of sand and dust one-eighth inch in depth. Sand storms have also been reported at Fort McDowell, Ariz., 11th, and at Wilcox, Ariz., 6th, 12th, 28th, 29th.

DROUGHT.

Winnemucca, Humboldt Co., Nev., 19th: reliable statements show that, in consequence of the prolonged drought, wheat sown last December yet remains in the ground plump and hard as when harrowed in. The ground was then dry, no rain having fallen for months, and it never has been moist enough since to sprout the grain. There are hundreds of acres sown to wheat and several acres sown to alfalfa, on the meadows, not one grain of which has sprouted, and the seed is apparently as sound as when it was sown. 30th: distressing accounts of loss of cattle from the scarcity of water along the Humboldt River continue to reach here. From Humboldt House, this county, west, the water holes in the Humboldt River bed are said to be lined with the decomposed carcasses of dead animals. The water in the sloughs and holes is impregnated with alkali, and when cattle, almost dying with thirst, reach there from the plains, they drink enough of poisonous water to kill them. A similar condition prevails on the Little Humboldt.—*The Silver State, Winnemucca, Nev., July 19th and 30th.*

Fresno, Cal., 31st: King's River, from where all the canals for irrigation in this section lead, is lower than it has been for seven years, and several of the large canals are closed. The water in this section is scarce.

Salt Lake City, Utah, 31st: the drought, which has prevailed during the entire month, continues. All vegetation in this section is withered, and the water is scarcely sufficient for household purposes.

Helena, Mont., 31st: the drought, which was already felt on the 30th of June last, has continued throughout this month, the amount of rainfall during the month being too small to be of any benefit. The crops in this section are completely ruined, some of them cannot even be cut for fodder, and the grass on the ranges has dried and blown away.

SUN SPOTS.

Mr. John W. James, Riley, McHenry Co., Ill.: none seen until the 12th, when the large spot reappeared; on meridian 18th, and disappeared by the solar rotation late on the 24th. From the 15th to the 21st two groups, very changeable, daily, of small spots were seen. 26th, small spots formed near the west edge; gone on the 28th. Still another new and changeable group formed near the east edge on the 30th and 31st, passing the sun's meridian August 2d. Mr. C. E. Buzzell, Leaf River, Ogle Co., Ill.: 13th, large spot appeared on the east limb by solar rotation, disappearing by solar rotation on the 24th. A new outbreak occurred just north of this spot while near the meridian on the 18th, subsiding on the 22d; this spot is a second period of the June 16th disturbance. 14th, small group newly formed near the meridian, disappearing on the 16th. 28th, a group of variable spots formed two days west of the meridian, disappearing in faculæ on the 30th. 29th, a variable group observed, two days in, on east limb, increasing on the 31st. Mr. M. A. Veeder, Lyons, Wayne Co., N. Y.: 1st, an extended group of faculæ was appearing by rotation, and continued active throughout its entire transit, being seen at the western limb on the 9th and 10th. This group returned also by rotation on the 26th, the small spots having formed meanwhile. On the 7th a group of faculæ appeared by rotation, and continued active throughout its entire transit, spots forming in connection with it when near the meridian on the 15th, and disappearing by rotation on the 20th. On the 10th, 11th, and 12th, an extended group of faculæ with a very large spot, seen also in June, came into view and persisted throughout the entire transit. On the 15th, faculæ appeared by rotation, and persisted, becoming the seat of a group of small spots when near the western limb on the 26th, disappearing by rotation on the 28th.

VERIFICATIONS.

FORECAST FOR 24 HOURS IN ADVANCE.

[Verifications made by Assistant Professor C. F. Marvin, assisted by Mr. H. E. Williams, chief clerk of the Forecast Division.]

The forecasts for districts east of the Rocky Mountains for July, 1889, were made by 1st Lieutenant Richard E. Thompson, 6th Infantry, Signal Officer and Assistant, and those for the Pacific coast districts were made at San Francisco, Cal., by 2d Lieutenant J. E. Maxfield, Signal Corps.

Percentages of forecasts verified, July, 1889.

States.		States.	
Maine	75.9	Eastern New York	76.7
New Hampshire	72.8	Western New York	82.6
Vermont	73.0	Eastern Pennsylvania	76.5
Massachusetts	77.7	Western Pennsylvania	84.1
Rhode Island	79.9	New Jersey	75.3
Connecticut	77.0	Delaware	69.9

Percentages of forecasts verified, July, 1889—Continued.

States.		States.	
Maryland	68.1	Lower Michigan	74.0
District of Columbia	71.2	Upper Michigan	81.7
Virginia	71.5	Wisconsin	79.8
North Carolina	80.2	Minnesota	80.6
South Carolina	80.5	Iowa	78.9
Georgia	79.3	Kansas	83.4
Eastern Florida	84.1	Nebraska	80.2
Western Florida	78.6	Missouri	84.4
Alabama	78.4	Colorado	84.7
Mississippi	81.8	Dakota	85.2
Louisiana	84.0	Southern California*	93.7
Texas	89.2	Northern California*	90.0
Arkansas	80.1	Oregon*	87.7
Tennessee	82.1	Washington Territory*	87.8
Kentucky	83.5	*By elements:* Weather	83.8
Ohio	82.3	Temperature†	72.8
West Virginia	85.0		
Indiana	79.7	Monthly percentage of weather and temperature combined†	79.4
Illinois	81.4		

• In determining the monthly percentage of weather and temperature combined, the Pacific coast states are not included. † The monthly percentage of weather and temperature combined is determined by multiplying the percentage of weather by 6, and the percentage of temperature by 4, and dividing their sum by 10. ‡ The forecasts of temperature in districts east of the Rocky Mountains for July, 1889, were, for the first time, made with reference to the maximum temperature alone; that is, a prediction of warmer or cooler indicated that the maximum temperature of the day designated would be higher or lower than the maximum of the previous day.

FORECAST FOR 48 HOURS IN ADVANCE.

Appreciating the great importance that long time predictions possess for the general public the Chief Signal Officer authorized forecasts for forty-eight hours, covering the second day, in advance. Such forecasts were optional with the predicting officer and were only made when clearly in the public interest, and covered, in all cases, considerable areas of country, and were not confined to localities.

Percentage of verifications of forecasts made for second day in advance: Number of predictions made: weather, 19; temperature, 41. Percentages of verifications: weather, 67.1; temperature, 71.5. Weather and temperature combined, 68.9.

CAUTIONARY SIGNALS FOR JULY, 1889.

Statement showing percentages of justifications of wind signals for the month of July, 1889:

Wind Signals.—(Ordered by 1st Lieutenant R. E. Thompson.) Total number of signals ordered, twenty-three; justified as to velocity, wholly thirteen; justified as to direction, twenty-two. All of the signals ordered were cautionary. Eleven signals were ordered for easterly winds, of which ten were justified, and twelve were ordered for westerly winds, all of which were justified. Percentage of justifications, 46.6.

Percentages of local verifications of weather and temperature signals as reported by directors of the various State Weather Services for July, 1889.

States.	Weather.	Temperature.	States.	Weather.	Temperature.
Illinois	73.1	75.8	New Jersey	83.0	94.0
Indiana	78.0	85.0	New York	87.0	86.1
Kentucky	86.0	90.0	Ohio	79.0	87.0
Michigan	83.4	83.9	Pennsylvania	81.0	91.0
Minnesota	71.0	80.0	South Carolina	86.0	88.5
Nebraska	74.6	85.6			

STATE WEATHER SERVICES.

[Temperature in degrees Fahrenheit; precipitation, including melted snow, in inches and hundredths.]

The following extracts are republished from reports for July, 1889, of the directors of the various state weather services:

ALABAMA.

The average temperature for the month has been nearly three degrees above the normal, and the month was marked by some very hot days, one station registering as high as 100 and several reporting as high as 98.

At some stations the precipitation has been greatly in excess of the normal, injuring the crops in those localities. The average for the state was 1.93 above the normal.

The seasons have been very good for the production of cotton and corn, and the indications for a good harvest are very flattering, though in some localities worms have made their appearance, and much complaint is made of the damaging effects of rust.

SUMMARY.

Temperature.—Monthly mean, 79.8; highest monthly mean, 86.4, at Columbiana; lowest monthly mean, 75.6, at Valley Head; maximum, 100, at Talladega, 24th; minimum, 62, at New Market and Valley Head, 6th, 9th; range for state, 38; greatest local monthly range, 33, at Montgomery, Talladega, and Valley Head; least local monthly range, 21, at Guntersville and Greensborough. *Precipitation.*—Average for the state, 6.01; greatest, 9.55, at Mobile; least, 1.65, at Talladega. *Wind.*—Prevailing direction, southwest.—*P. H. Mell, Signal Corps, Auburn, director.*

ARKANSAS.

SUMMARY.

Temperature.—Monthly mean for the state, 80.3; highest monthly mean, 82.5, at Lead Hill; lowest monthly mean, 76.4, at Ozone; maximum, 107, at Lead Hill, 18th; minimum, 53, at Eureka Springs, 30th and 31st; range for state, 54; greatest local monthly range, 49, at Lead Hill; least local monthly range, 19, at Conway.

Precipitation.—Average for the state, 5.04; greatest monthly, 12.00, at Russellville; least monthly, 2.10, at Heber.—*Prof. John C. Branner, Little Rock, director; W. U. Simons, Sergeant, Signal Corps, assistant.*

COLORADO.

SUMMARY.

Temperature.—Monthly mean, 66; highest monthly mean, 77.3, at Cañon City; lowest monthly mean, 54.9, at Climax; maximum, 107, at Julesburgh, 6th; minimum, 25, at Breckenridge, 3d; range for state, 82.

Precipitation.—Average for the state, 1.64; greatest monthly, 3.52, at Julesburgh; least monthly, 0.10, at Gunnison.—*Prof. F. H. Loud, Colorado Springs, director; T. W. Sherwood, Sergeant, Signal Corps, assistant.*

DAKOTA.

SUMMARY.

Temperature.—Monthly mean, 70; highest monthly mean, 73, at Yankton; lowest monthly mean, 58, at Wahpeton; maximum, 106, at Valentine, Nebr., 5th and 6th, and Roscoe, 6th; minimum, 37, at Brookings, 4th, and at New England City, 8th; range for state, 69.

Precipitation.—Average for the state, 3.13; greatest monthly, 7.07, at Webster; least monthly, 0.63, at Fort Buford; greatest daily, 2.89, at Webster, 11th. *Wind.*—Prevailing direction, southeast.—*S. W. Glenn, Sergeant, Signal Corps, Huron, in charge.*

ILLINOIS.

SUMMARY.

Temperature.—Monthly mean, 74.1; maximum, 102, at McLeansborough, 12th; minimum, 49, at South Evanston, 16th; range for state, 53.

Precipitation—Average for the state, 4.70.

Wind.—Prevailing direction, southeast.—*John Craig, Sergeant, Signal Corps, Springfield, in charge.*

INDIANA.

July, 1889, was a wet as well as a cool month. Rains fell quite frequently and at many stations in large quantities during a few hours. Everywhere, in comparison with the normals, the amounts measured were greatly in excess, ranging from 0.67 to 5.56, except at Farmland, where the amount was slightly deficient, 0.15, showing that the rainfall was probably badly distributed. The greatest excess occurred in the southern portion, 2.81; in the northern portion the excess was 2.04; and the least excess occurred in the central portion. The excess for the state over a normal of seven years was 1.85. The rains were frequently accompanied by lightning and thunder, and by hail on the 24th and 26th at Butlerville, and on the 26th at Cannelton, Worthington, Crawfordsville, and other neighboring places; that at Crawfordsville was exceedingly large, nearly as large as hen's eggs, and the track of the storm was about a mile wide. Much damage was done to crops and trees. Some of these storms were accompanied by exceedingly strong winds for a short time.

SUMMARY.

Temperature.—Monthly mean, 73.9; highest monthly mean, 77.3, at Huntingburgh, lowest monthly mean, 7.02, at Columbia City; maximum, 97, at Angola, 2d and 10th; minimum, 50, at Delphi and Columbia City, 5th; range for state, 37; greatest local monthly range, 45, at Mauzy; least local monthly range, 21, at Butlerville. *Precipitation.*—Average for the state, 5.41; greatest, 10.50, at Marengo; least, 3.10, at Marion.

Wind.—Prevailing direction, southwest.—*Prof. H. A. Huston, La Fayette, director; C. F. R. Wappenhans, Sergeant, Signal Corps, assistant.*

IOWA.

July, 1889, averaged nearly normal in temperature, rainfall, and cloudiness; southerly winds and calms prevailing; it was, therefore, mainly a favorable month for crops.

The mean temperature of the air was but very little above normal. The first two decades were decidedly warm, being 2 above normal; the last decade was markedly cool, being over 3 below normal. Nine of the ten hot days of the month fell in the first two decades; and the 1st, 8th, and 18th were the hottest of these. The last two days were the coldest, being 10 below normal, that is, corresponding to the normal temperature of middle September.

The mean cloudiness was less than normal, and while we had 13 clear days there was only 1 cloudy day during July.

The total rainfall during July averaged about normal for the entire state. At the central station it exceeded normal by 14 per cent. Along the Mississippi, from Lee to Jackson counties, the rainfall exceeded 4.00, nearly reaching or exceeding 7.00 at Denmark, Muscatine, and Clinton. A broad belt extending eastward from Harrison and Page to Johnson and Linn counties, also received over 4.00 of rainfall, reaching 7.00 locally in Jasper county. The northwest, as far as Kossuth and Harrison counties, generally received over 5.00, exceeding 7.00 in Monona and Sac counties.

The total rainfall was least in the north and northeast, from Concord to McGregor, and from Mitchell county to Buchanan county; throughout this territory, amounting to nearly one-eighth of the state, the rainfall was insufficient, being less than 2.00. From Concord over Butler to Bremer county the rainfall was even less than 1.00. The territory of Iowa not above specified received sufficient rainfall, from 2.00 to 4.00.

The greatest rainfall occurred on the 2d in the southeast, on the 8th and 9th in the north, on the 13th and 14th from Audubon and Adams counties east to the Mississippi, on the 17th in the extreme southeast, on the 25th in the northeast. The highest single rainfalls reported are nearly 5.00 in Monona county